Headquarters U.S. Air Force

Integrity - Service - Excellence

U.S. Air Force Energy Program

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SAF/IEN
May 2011

U.S. AIR FORCE

Report Documentation Page

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Why We Fly







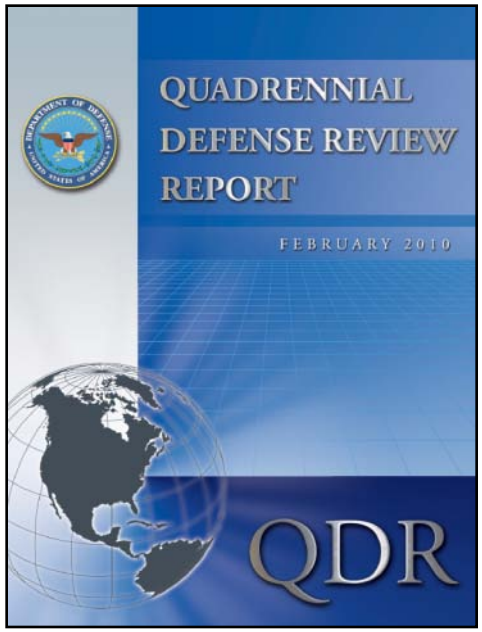



Quadrennial Defense Review

February 2010

Energy Security – "*assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs" – pg 87*

- DoD will
  - promote investments in energy efficiency
  - ensure that critical installations are adequately prepared for prolonged outages caused by natural disasters, accidents, or attacks
- Balance energy production and transmission to preserve test and training ranges and operating areas needed to maintain readiness



"**Energy efficiency** *can serve as a force multiplier, because it increases the range and endurance of forces in the field and can reduce the number of combat forces diverted to protect energy supply lines…" – pg 87*

QDR energy security definition is consistent with Air Force strategy and priorities for both installations and operations

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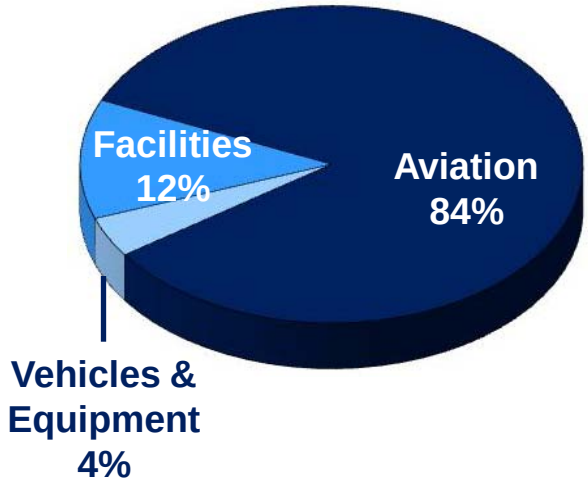
Why is the AF looking at energy…

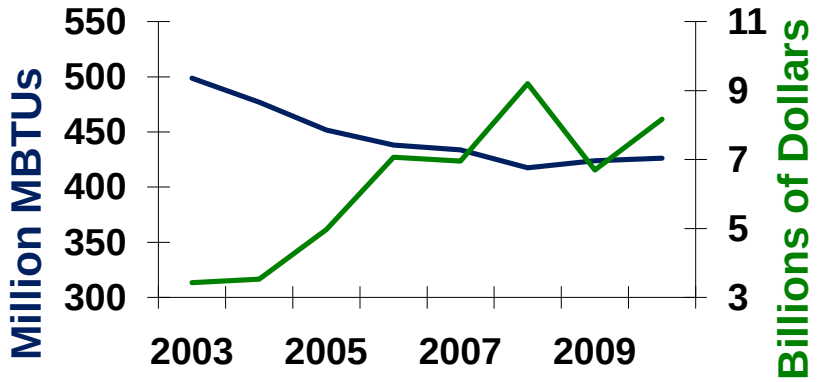
- **Enables our warfighters and increases operational capabilities**
- **Lowers energy consumption and costs by implementing energy efficiencies and new technologies**
- **Addresses the impact of climate change as a threat multiplier**
- **Provides positive environmental benefits by using alternative energy sources**

Air Force is pursuing an Energy Security Posture that is ROBUST, RESILIENT, AND READY

Cost Breakdown



Cost and Consumption Trends



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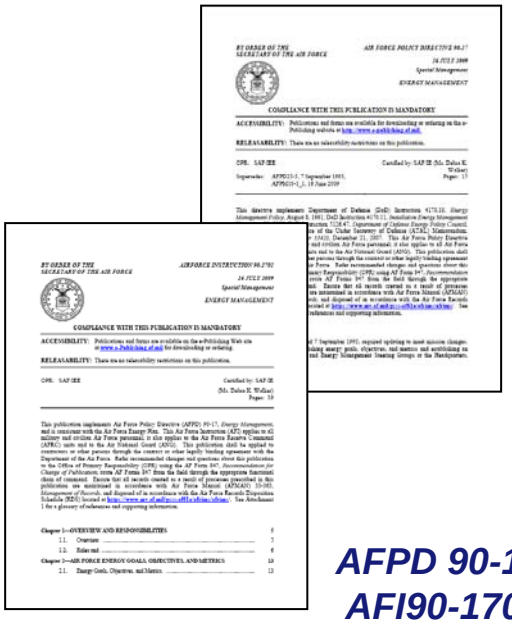
…and what the AF is doing about it

3-Part Strategy

Reduce Demand ***Increase Supply***

Change the Culture

USAF Energy Plan
Issued 9 Dec 2009



AFPD 90-17
AFI90-1701
Signed 16 July 2009

Vision

Make Energy A Consideration In All We Do

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Air Force Energy Goals…

Aviation Goals

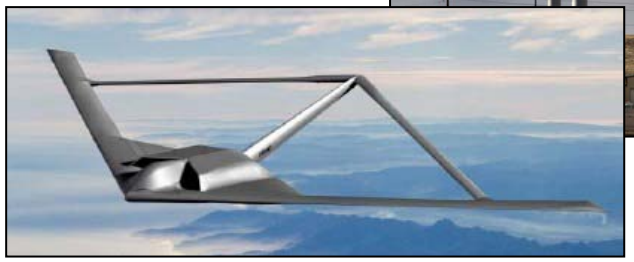
- **Reduce aviation fuel consumption by 10% from 2006 baseline**
- **Be prepared to acquire 50% of domestic aviation fuel requirements via an alternative fuel blend by 2016**

Installation Energy

- **Reduce energy intensity by 3% annually**
- **Increase renewable energy use to reach 25% by 2025**

Motor Vehicles

- **Reduce fuel use by 2% annually**
- **Increase alt fuel use by 10% annually**



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…And how we are doing

Aviation Goals

- Reduced aviation fuel consumption 2% from FY06-FY10
- On track to certify fleet on synthetic fuel blend by early 2011

Installation Energy

- Reduced installation energy intensity nearly 15% since FY03
- Renewable energy represented 6.4% of total electric power consumption in FY10

Ground Vehicles

- Reduced petroleum consumption by 1.1M gals (4.7%) since FY08
- Increased alternative fuel consumption by over 400,000 gals (31.0%) since FY08
- Maintaining over 7,000 flex fuel and hybrid vehicles, and down-sized vehicles where possible to more efficient models

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Operational Energy

	Installations	Operational
Mobility Fuels	Non-Tactical Vehicles Equipment	Aviation
Power Generation	Utilities Electric Grid Critical Infrastructure	Expeditionary Bases

70% of DoD energy required for moving and sustaining military forces and weapons platforms for military operations

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Air Force Energy Governance

Air Force Energy Council
Co-Chairs: SAF/US and AF/CV
Attendance Level: ★ ★ ★
Members: IE, AQ, FM, US(M), IA, PA, GC, A3/5, A4/7, A6 CIO, A8, A9, ST, MAJCOM EMSG Chairs
Executive Secretary: SAF/IEN
Frequency: Quarterly

Air Force Energy Integration Board
Chair: SAF/IE PDAS
Attendance Level: ★ ★ ★ / ★ ★
Members: Steering Group Chairs
Frequency: Quarterly

Colonel's Action Group
Chair: SAF/IEN
Members: HAF & MAJCOM
Frequency: Bi-Weekly

Aviation Operations Energy SG
HAF Chair: AF/A3O
MAJCOM Champ: AMC

Infrastructure & Expeditionary Energy SG
HAF Chair: AF/A7C
MAJCOM Champ: ACC

Partnerships & Outreach Energy SG
HAF Chair: SAF/IEN
MAJCOM Champ: AETC

Planning, Requirements & Acquisition Policy Energy SG
HAF Chair: AF/A8X
MAJCOM Champ: None

Acquisition and RDT&E Energy SG
HAF Chair: **SAF/AQR**
MAJCOM Champ: **AFMC**

Energy Management

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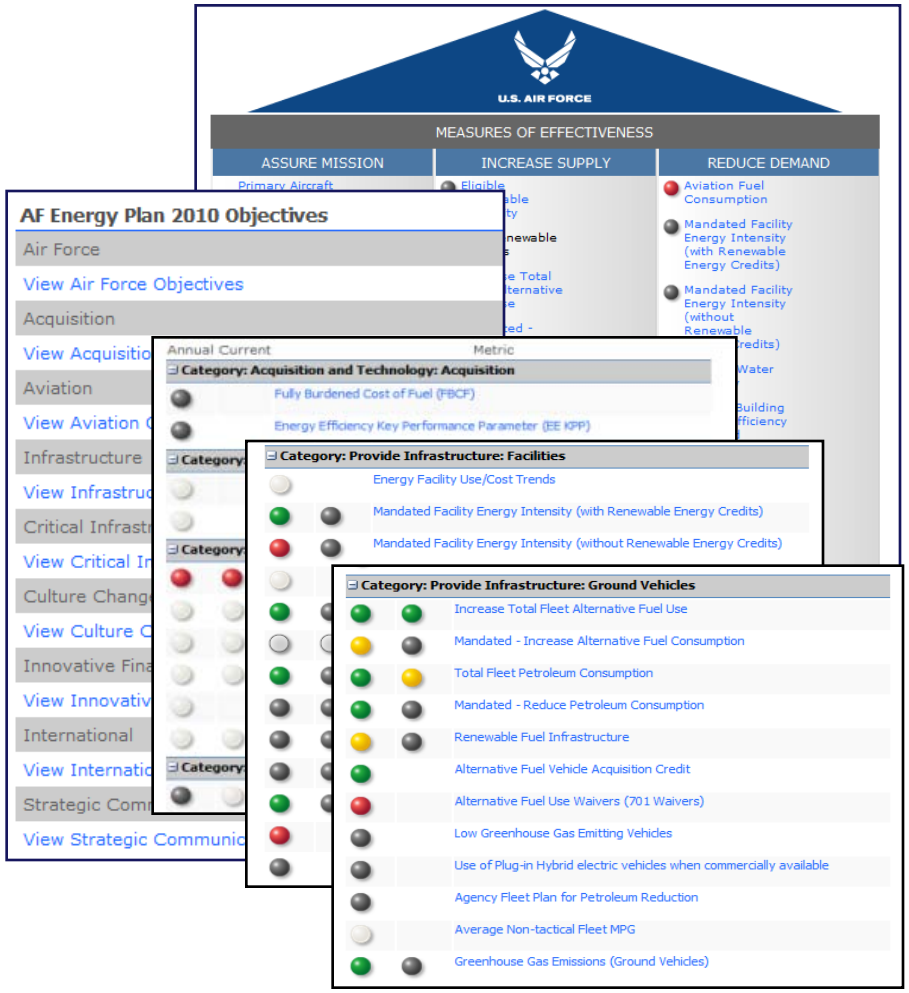
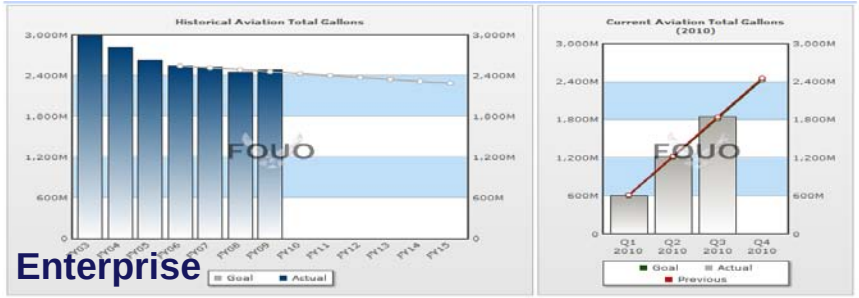
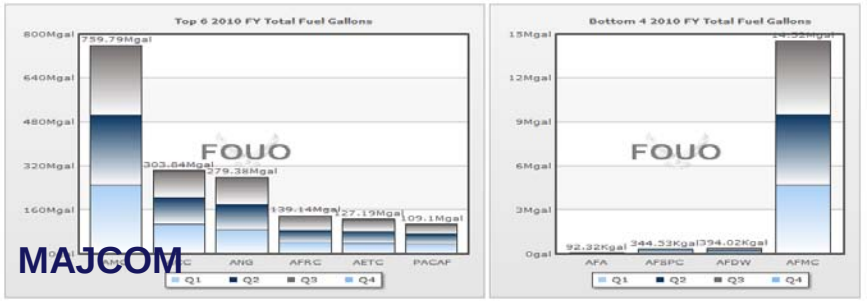
Enterprise Management



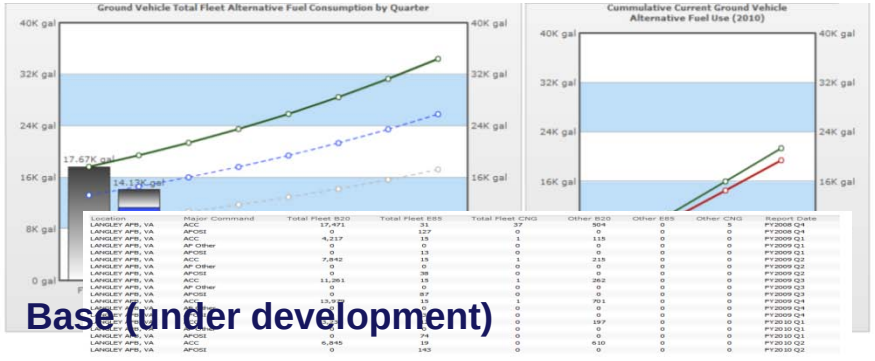
Functional Management



Enterprise



MAJCOM



Base (under development)

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Increasing Operational Capabilities by Reducing Energy Demand

- **Reducing aircraft weight by removing unnecessary equipment**
- **Removing "standard ramp load" practice**
- **Optimizing operations planning and execution of mobility aircraft**
- **Lowering cruising speed when possible**
- **Identifying logistical changes to enable additional cargo deliveries**
- **Requiring all vertical construction projects with climate control be capable of LEED Silver standard**

Decreasing fuel demand by maximizing efficiencies will increase Air Force combat capability and enhance energy security

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Aviation Initiatives To-date

- Air Force Aviation Policy Changes
  - Flight Operations
  - Ground Operations
- Air Force Recapitalization program—T-6 Texan
- Aviation Energy Partnership and Outreach
  - Aviation Operations Energy Steering Group Fuel Summit
  - Total Force Energy Analysis Task Force

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FY12-16 Energy Initiatives

- Optimized crew ratios
  - A-10 crew ratio from 1.5 to 1.25
  - FYDP fuel savings approx $105M/34M gallons
- 5 % CAF-Wide Flying Hour Program Adjustment
  - Increase use of Simulation
  - More efficient mission planning tools
  - In-depth review of individual flight training requirements
  - FYDP savings ~ $880M/290M gals, FY12 ~ $160M/53M
- Funds investment of 12 AMC fuel saving initiatives
  - FYDP fuel savings $325M/107M gals, FY12 $46M/15M gals

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AMC Fuel Saving Initiatives

- Aircraft Weight Reduction
- Eliminated C-5 Fuel Bias in Flight Planning
- Reduced Auxiliary Power Unit (APU) Usage
- Optimize C-5 and C-17 Center of Gravity
- Optimize Diplomatically Cleared Routings
- European Routing
- C-17 Eco Power Wash
- KC-10 Coke Clean

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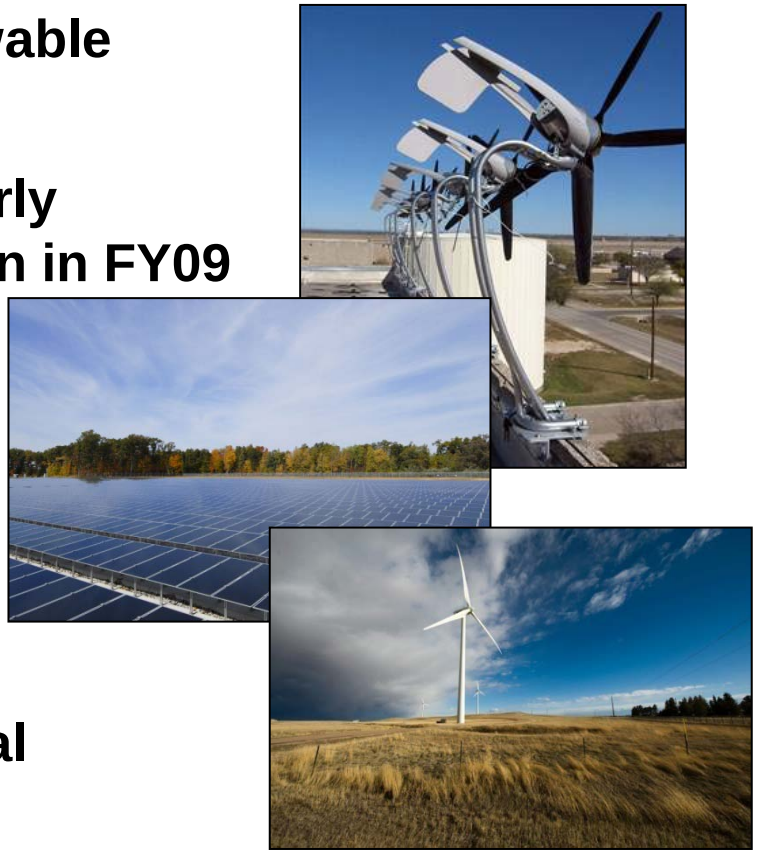
Improving Energy Availability by Increasing Renewable Energy Use

- **2nd Largest Federal purchaser of renewable energy**
  - **Renewable energy represented nearly 6% of Air Force energy consumption in FY09**
- **Operating 85 on-base renewable energy projects on 43 bases, with 31 underway or planned for construction**
  - **Moving to quadruple on-base solar energy production starting in 2011**
  - **Developing over 69 MW of additional wind energy over next 4 years**



For operations, it is clear we'll…continue to press for more efficient and renewable energy solutions for both aircraft and our installations.
-Michael Donley, Secretary of the Air Force, 13 September 2010

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Assuring Critical Missions through Energy Security

- Testing and certifying alternative aviation fuels to help improve energy security posture by providing domestic alternatives to foreign oil
- Partnering with industry to develop on-base, resilient sources of power
- Ensuring critical assets have the power to operate in the event of a natural disaster or attack
- Demonstrating microgrid technology to determine its security, reliability and cost effectiveness

Energy Security means having assured access to reliable supplies of energy and the ability to protect and deliver sufficient energy to meet operational needs

-2010 Quadrennial Defense Review

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Energy Horizons: Air Force Energy S&T Strategy

Vision

Assured energy advantage across air, space, cyberspace and infrastructure

Objective

- **Accelerating S&T to enable revolutionary energy capabilities for Air Force missions**
- **Mid (FY16-20) and long (FY21-25) term**
- **Advancing systems, operations, culture**
- **Leverages internal/external partnerships**

"For the Air Force's part, we must embrace the notion that energy efficiency is not a stand-alone priority because it binds together and enables every dimension of our mission; and the idea that energy efficiency affords us greater resiliency, which translates to greater capability and versatility."

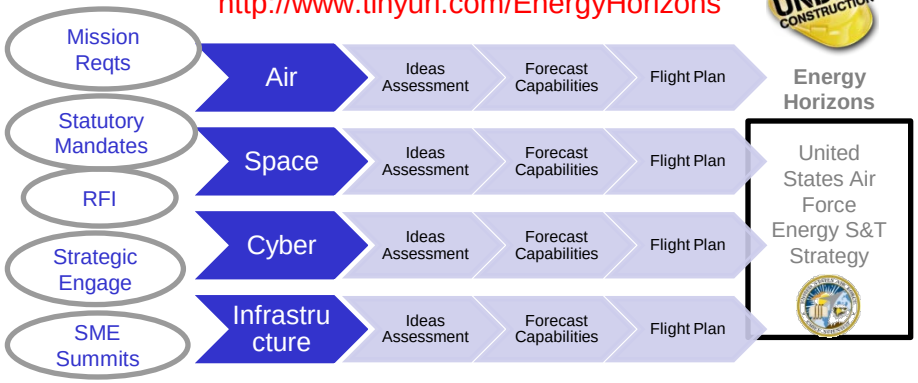
Gen. Norton Schwartz, CSAF

"Changing the culture means that all of us, from the Air Staff to Airmen at home or deployed, must learn to think of energy as part of maximizing mission effectiveness."

Ms. Erin Conaton, USecAF

Approach

http://www.tinyurl.com/EnergyHorizons



Revolutionary

Air

Space

Cyber

Infrastructure

Notional Energy S&T Roadmap

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A roadmap of science and technology focus areas to optimize energy efficiency in current, next generation, and future aircraft and meet Air Force energy goals

Alt Fuels Analysis

Manufacturing Methods

Energy Harvesting

New Efficient Engines

Enabling Technology Areas

Weight-optimized Composites

Multi-Function Structures

Aerodynamics

Propulsion Integration

Novel Materials and Power sources

Revolutionary Configurations

Future Aircraft

High Temperature Materials (2700º F)

Highly Efficient Engines (reduce SFC 35%)

Advanced Materials and Composites

Efficient Small Scale Propulsion

Next Generation Aircraft

Adaptive Engines (reduce SFC 25%)

Energy Optimized Aircraft

Far-term

Mid-term

Near-term

Drag Reduction

Finlets and Micro-vanes

Winglets

Formation Flight

Alt Fuels Cert Support

Virtual Training

Legacy Aircraft

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Alternative Aviation Fuels Current Certification Efforts

- Synthetic aviation fuel blends
  - 50/50 blend of JP-8/synthetic fuel produced via the Fischer-Tropsch (FT) process
  - FT component is made from a carbon source (e.g, coal, natural gas, biomass)
- Biomass-derived aviation fuel blends
  - 50/50 blend of JP-8/“hydroprocessed renewable jet” (HRJ) biomass-derived fuel
  - HRJ component is liquid fuel made from biologically sourced fats and oils (e.g., camelina, tallow)

Alternative Fuels Enhance Long-term National Security

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Benefits of Alternative Aviation Fuels

- Improves energy security posture by providing domestic alternatives to foreign oil
- Increases the supply of aviation fuel available to the Air Force
- Provides economical alternatives
  - Increases the feedstocks and diversity in the marketplace
  - Will only purchase cost-competitive alternative aviation fuels
- Offers environmental benefits
  - Any alternative aviation fuels must be greener than traditional petroleum

"There is a very real, very present connection between our dependence on energy — namely, oil — and our national security."

– General Schwartz
Air Force Chief of Staff
27 May 2010

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Synthetic Aviation Fuel Blend

- **Pathfinder Aircraft – first Air Force aircraft to be certified to use synthetic fuel blend: B-52 in August 2007**
- **First transcontinental flight using synthetic fuel blend: C-17 in December 2007**
- **First supersonic flight conducted using a synthetic fuel blend: B-1B in March 2008**
- **First fighter demonstration flight using a synthetic fuel blend: F-15 in August 2008**
- **First aerial refueling using a synthetic blend fuel: F-22 and KC-135 in August 2008**

Over 99% of our aircraft can now conduct unrestricted operations using a 50/50 synthetic fuel blend

Biomass-Derived Fuel Blends

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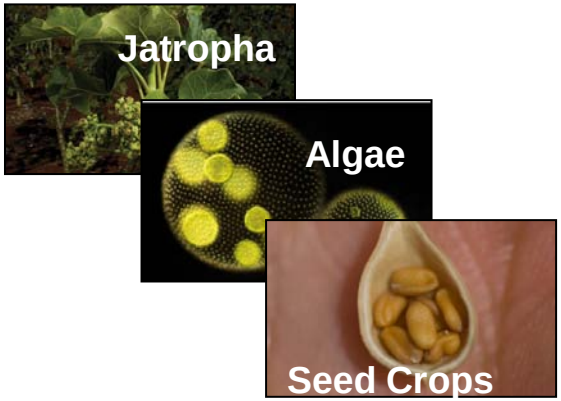
- Efficiencies and lessons learned from synthetic fuel certification resulting in faster certification
- Certified C-17 for unrestricted operations on 4 Feb 2011; first Air Force aircraft to be certified to use HRJ fuel blend
  - Flew C-17 Globemaster on blend of JP-8, FT synthetic fuel, and HRJ fuel
- Certified the F-16 through similarity
- Flew A-10 Thunderbolt II on HRJ fuel blend
  - First-ever flight of an aircraft powered solely on a biomass-derived jet fuel blend
- Future HRJ certification flight tests: F-15 Eagle, F-22 Raptor and RQ-4 Global Hawk



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Alternative Aviation Fuels Way Forward

- Complete synthetic fuel blend fleet certification by early 2011
- Achieve “generic” HRJ fuel blend fleet certification using pathfinder approach by end of 2012
- Continue working with other Services and commercial industry
- Support government and industry efforts to develop alternative aviation fuel market
- Ensure Air Force is prepared to purchase alternative aviation fuels by 2016

Air Force depends on commercial suppliers for actual fuel production and availability

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Partnering with Other Federal Agencies

- Energy surety is a critical component of Air Force mission assurance
- Leveraging resources and capabilities through partnerships with Sister Services and other Federal agencies
- Partnerships include:
  - Working with Sandia Labs Energy Surety Microgrid to assess "smart grid" capability at 4 Air Force bases
  - Partnering with FAA on next generation air traffic control system
  - Collaborating with NASA on aircraft design, propulsion and materials development, and aviation safety

DOE and DoD intend to develop and conduct cooperative activities relating to identified high priority energy strategic needs, where such cooperation contributes to the efficiency, productivity and overall success of the activity.

-DoD-DOE Memorandum of Understanding

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Working with Industry

- Continuing to seek out interagency and industry partnerships to expand renewable energy portfolio
  - Power Purchase Agreements
  - Enhanced Use Leases
- Partnering with industry and others to develop recommendations to maintain or improve mission capability, while improving resiliency and security of power delivery
- Working with aviation industry to test and certify alternative aviation fuels

[Achieving our energy goals] will demand creativity, innovation, and close collaboration throughout the entire national security community comprising the federal government, academia, and industry.
-General Norton Schwartz, Air Force Chief of Staff 28 May 2010

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Summary

- Energy is a force multiplier
- Implementing multiple technical and procedural efforts to reduce the demand for energy
- Working to change the mindsets of all Airmen to ensure energy is a consideration in everything they do
- Striving for a Robust, Resilient and Ready energy security posture to support the full spectrum of Air Force missions and operations

"For the last several years, from my perspective, the Air Force has led the way in energy."

–Admiral Mike Mullen, Chairman of the Joint Chiefs of Staff, October 2010

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http://www.safie.hq.af.mil/